Category: Transportation Refrigeration Units (TRUs)

Transportation refrigeration units (TRUs) are gasoline and diesel powered cooling units that are installed on vehicles used in transporting produce, meat, dairy products, and other perishable goods. TRUs are found on refrigerated vans, trucks, trailers, and railcars. The TRUs emissions inventory from the OFFROAD Model is an estimate of the amount and types of pollutants emitted from those thousands of pieces of equipment.

There are two types of equipment that are included in the TRUs category:

Equipment Type	Gasoline 2-Stroke	Gasoline 4-Stroke	Diesel
Transportation Refrigeration Units		X	X
Generator Sets			X

Emissions Inventory:

As with other OFFROAD equipment types, the emissions inventory for the TRUs category is calculated as the product of the emission rate (grams per horsepower-hour), engine population, and activity (hours per year) in annual average use hours.

Calculating Emissions Inventory (PDF Format)

For the current emissions inventory (tons/day):

Air Resources Board Almanac

Input Data Sources:

The input factors used by the OFFROAD Model come from various data sources:

Input Factor	Source of Data (Diesel)
Population (base year 2000)	ARB Survey of TRUs Manufacturers (2003)
Useful Life	ARB Survey of TRUs Manufacturers (2003)
Activity (hr/yr)	ARB Survey of TRUs Manufacturers (2003)
Activity by Age	ARB Survey of TRUs Manufacturers (2003)
Average horsepower	ARB Survey of TRUs Manufacturers (2003)
Load factor	ARB Survey of TRUs Manufacturers (2003)
Allocation factor	Energy & Environmental Analysis (EEA) document (1995)
Growth factor	DRI/McGraw-Hill employment data (1994)
Survival rate	Power Systems Research (1996)

For more additional background information on the input factors used by the OFFROAD Model: *(Document Link)*

For tables of input data for TRUs: *(Document Link)*

Adopted Regulations for Transportation Refrigeration Units:

2004: Board approved Airborne Toxic Control Measure for TRU and TRU Generator Sets. Please visit our web site at http://www.arb.ca.gov/regact/trude03/trude03.htm. The regulatory document may be viewed and downloaded form here. This regulation is not currently reflected in the model.

The ATCM requires in-use TRU and TRU gen sets engines that operate in California, including out-of-state units while they are operation in California, to meet specific performance standards that vary by horsepower (hp) range. The performance standards affecting in-use engines follow the proposed U.S. EPA Tier 4 new nonroad engine standards, and could be met by: (1) using an engine that is certified to the Tier 4 diesel PM emission level, (2) equipping the existing engine with the appropriate level of verified diesel emissions control system, or (3) using an "alternative technology" that eliminates TRU diesel engine operation (and emissions) while at a facility. Alternative technologies include electrification, cryogenic refrigeration systems, alternative fuel systems, exclusive use of alternative diesel fuel, fuel cell-powered refrigeration systems, and other technologies that eliminate diesel engine PM emissions while at a facility.

A thorough technology review will be provided to the Board in 2007 and 2009 to ensure that technologies are available to meet the compliance schedule. The in-use performance standard will be phased-in over time. This phase-in will accelerate the upgrade or replacement of TRUs and TRU generators by requiring incrementally more stringent in-use engine performance standards on a seven-year cycle. (Note: according to the refrigerated transpiration industry, most TRUs are currently replaced after 10 or more years of use).

Future Improvements to Transportation Refrigeration Units Category:

- Update OFFROAD model to reflect adopted regulations
- Spatial allocation of emissions